joining the pedestal, the heat spreader module, the insulating board, and the metal plate together. Claim 8 further recites that the active hard brazing materials are supplied such that the active hard brazing materials have a thickness ranging from 3 to 20 μm when the active hard brazing materials are melted, and the active element is contained in an amount ranging from 400 to 1,000 $\mu m/cm^2$.

The Examiner's assertion, on page 2 of the Office Action, that "Dubois et al. discloses in figure 2, a heat spreader module constructed by supplying active hard brazing materials (16, 18, 23-26) each containing an active element (all elements are active in function)" is incorrect for at least two reasons. First, Dubois does not disclose the use of hard brazing materials. With reference to annotated Fig. 2 (from Dubois) shown below (some details removed for clarity), the attachment devices disclosed in Dubois will be discussed in further detail.

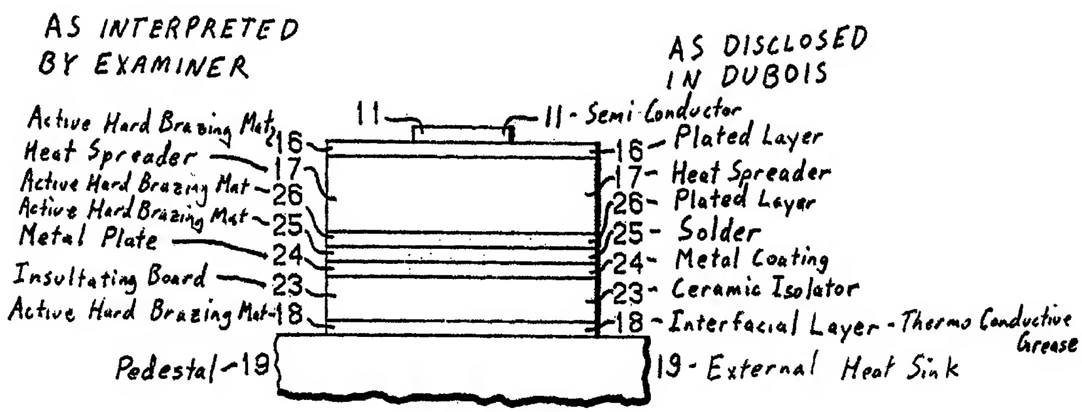

FIG 2

To help correct the Examiner's interpretation of Dubois, please note that the terms provided on the left side of the annotated figure are those provided by the Examiner in the Office Action, and those terms provided on the right side of the annotated figure are those disclosed in Dubois.

Alleged hard brazing material 18 -

This layer is disclosed in Dubois, in Column 4, lines 30-34, to be an interfacial layer 18, which exists in all devices that are only mechanically coupled to a heat sink 19. Dubois discloses that the interfacial layer 18 can be filled with a thermally conductive grease to reduce the thermal impedance of the interfacial layer. Clearly, the alleged hard brazing layer 18 of Dubois is not a hard braze, but rather is a layer of thermally conductive grease used to reduce the thermal impedance between two objects that are mechanically clamped together.

Alleged hard brazing material 16 -

This layer is disclosed in Dubois, in Column 5, lines 6-8, to be an optional plating layer. Dubois does not disclose or suggest any particular composition of the plating layer 16. However, it is clear that the plating layer 16 is not a hard brazing material.

Alleged hard brazing material 25 -

This layer is disclosed in Dubois, in Column 5, line 12, as a solder layer 25. Solder is well known in the art to be a material used in joining that has a melting point below 450°C. Quite to the contrary, hard brazing materials have significantly higher melting points (well above 450°C) requiring significant changes in both joint design and assembly process techniques. Changing from solder to a hard brazing material is not merely a choice made by a

customer. Any such change requires a significant redesign to ensure compatibility with the high temperatures required by the hard brazing materials, the requirements of such design not being something known by one having ordinary skill in the art.

For at least the foregoing reasons, Dubois fails to disclose any use of hard brazing materials. Specifically, with reference to annotated Fig. 2 from Dubois shown above, Dubois fails to disclose any active hard brazing materials supplied between the pedestal, a heat spreader member, an insulating board, and a metal plate, as recited in claim 8.

Second, the Examiner is respectfully requested to recognize the meaning of an "active element." In the Office Action, the Examiner stated that "all elements are active in function." This is not true within the context of the present claim language. As disclosed on page 13, lines 5-15, active elements were respectively selected from particular groups depending on the adjoining materials. For example, titanium is chemically active with the some adjoining materials, but not others. One skilled in the art understands that all elements are not chemically active with respect to all materials.

In addition to the support found within the specification for the definition of the term "active," Applicants respectfully submit that one skilled in the art would have readily understood that the term "active" means chemically active. For example, the Examiner is respectfully requested to note the following selections translated into English from the Japanese article "Bonding of Ceramics to Metals" in the technical magazine **Surface Science**, Vol. 4, No 1, 1983. In relevant part the article states:

> (From the second to last line of the right column of page 7 to line 6 of the left column of page 8.)
>
> 4.3 Bonding Ceramics to Metals Using Active Metal Method
>
> This method utilizes a highly active metal such as Ti, Zr, and a material such as Ni, Cu and Ag for forming alloys having a relatively low melting point. The alloy of the active metal and the material such as Ni, Cu

and Ag is interposed between a ceramic material and filler metal such that the alloy forms a eutectic composition. According to this method, the ceramic material, the filler metal and the alloy are bonded together when heated once in a vacuum or in an inert gas.

As shown in Table 4, the active metal and the material such as Ni, Cu and Ag form various solder compositions having slightly different sealing temperatures.

(From the last two lines in the left column of page 8)

For example, the active metal method for bonding sapphire and titanium using a Ti-Ni alloy is explained below.

(From line 8 in the right column of page 8 to line 9 in left column of page 9)

It is assumed that the process of bonding in this case is as follows:

When bonding, Ti in the Ti-Ni solder composition is selectively adsorbed to an interface of sapphire, and then a part of Ti adsorbed to the interface of sapphire is oxidized. Thus formed oxidized titanium such as Ti_2O_3, TiO reacts with sapphire (α-Al_2O_3). Alternatively, Ti ions are diffused in an Al_2O_3 crystal structure. Thus, an intermediate layer of a Ti-Al-O solid solution or a Ti-Al-O compound is formed. As a result, strong, vacuum-tight bonding can be achieved.

Here in the bonding of a Ti-Ni solder composition and sapphire (Al_2O_3), titanium plays a far more effective role than nickel.

(From the first to fourth lines in the left column of page 10)

The resultant bonding with high strength shows that the bonding between ceramics and metals is not a simple mechanical bonding but an interatomic bonding.

A copy of the original Japanese text has been attached for the Examiner's reference.

For at least the foregoing reasons, it should be apparent that the Examiner's assertion that "all elements are active in function" is technically incorrect, and it should be apparent that Dubois fails to disclose or suggest the use of active hard brazing materials.

In addition to the arguments submitted above, the Examiner's assertion on page 2 of the Office Action, that "it appears layers are being pressed and heated" is without basis. There is no teaching or suggestion in Dubois that the structure disclosed therein is simultaneously heated and pressed to form the structure.

Furthermore, the Examiner is respectfully requested to note that the method of Dubois uses soldering for bonding glassy dielectric materials to metallized components, as disclosed in the Abstract and Fig. 2. Applicants respectfully submit that one skilled in the art would readily understand that the methods of Dubois are not similar or relevant to a process of direct brazing ceramic materials.

Asakura fails to overcome the deficiencies of Dubois. Asakura discloses platings for electrical terminals. The disclosure of Asakura would not have taught or motivated one skilled in the art to attach various layers of the semiconductor power device in Dubois using active hard brazing materials. Okikawa, also used by the Examiner for its apparent disclosure of a particular amount of an active element, would not have overcome the deficiencies of Dubois. Further, Ishikawa, used by the Examiner only for its alleged disclosure of a particular heat spreader member, would not have overcome the deficiencies of Dubois.

For at least the foregoing reasons, a heat spreader module constructed by supplying active hard brazing materials, each containing an active element, between a pedestal, a heat spreader member, an insulating board, and a metal plate as recited in claim 8 would not have been obvious to one skilled in the art given the disclosures of Dubois, Asakura, Okikawa and Ishikawa. Since claim 9 depends directly from claim 8, claim 9 is also believed to be allowable over the applied prior art.

2. As indicated above, claim 10 is similar to claim 8, but recites that the metal plate includes a marginal edge of alloy having a width within a range of 200 μm.

For at least the reasons stated above, Dubois fails to disclose the inclusion of hard brazing materials, each containing an active element, between a pedestal, a heat spreader member, an insulating board, and a metal plate. Because Dubois does not disclose joining these members using an active hard brazing material by pressing and heating, there will not be a resulting metal plate including a marginal edge of alloy having a width within the range of 200 μm.

The Examiner's comment on page 4 of the present Office Action, that "it is old and well known for one [of] ordinary skill in the art to design their products to have a width within the range of 200 μm depending on customer requirements such as cost, size, strength and materials usage" is misplaced. The process disclosed in Dubois clearly does not even provide for the basic requirements, such as an active hard brazing material, which could create the marginal edge of alloy. Furthermore, such an alloy could not be created using the process of Dubois even if the proper materials were present. Therefore, a heat spreader module having a metal plate including a marginal edge of alloy having a width within a range of 200 μm, as recited in claim 10, would not have been obvious to one skilled in the art given the process and product disclosed in Dubois regardless of customer requirements.

As discussed above, Asakura, Okikawa and Ishikawa all fail to overcome the material and process deficiencies of Dubois. Therefore, a heat spreader module constructed using the process recited in claim 10 would not have been obvious to one skilled in the art given the disclosures of Dubois, Asakura, Okikawa and Ishikawa. Since claim 11 depends directly from claim 10, claim 11 is also believed to be allowable over the applied prior art.

For at least the foregoing reasons, Applicants respectfully submit that claims 8-11 define patentable subject matter over the art of record. Accordingly, reconsideration and withdrawal of the present rejection are respectfully requested.

For at least the foregoing reasons, Applicants respectfully submit that all pending claims herein define patentable subject matter over the art of record. Accordingly, the Examiner is requested to issue a Notice of Allowance for this application in due course.

If the Examiner believes that contact with Applicants' attorney would be advantageous toward the disposition of this case, the Examiner is herein requested to call Applicants' attorney at the phone number noted below.

The Commissioner is hereby authorized to charge any additional fees associated with this communication or credit any overpayment to Deposit Account No. 50-1446.

Respectfully submitted,

February 7, 2007
Date

Timothy D Evans

Stephen P. Burr
Reg. No. 32,970

Timothy D. Evans
Reg. No. 50,797

SPB/TE/eav

Attachment:
Haruo Takashio, "Bonding of Ceramics to Metals," **Surface Science**, Vol. 4, No 1, 1983

BURR & BROWN
P.O. Box 7068
Syracuse, NY 13261-7068

Customer No.: 025191
Telephone: (315) 233-8300
Facsimile: (315) 233/8320